

REMARKS

The Office Action mailed June 6, 2001, has been received and reviewed. Claims 1 through 13 are currently pending in the application. Claims 1 through 13 stand rejected. Claim 7 is objected to because of informalities. Applicants have amended claims 1, 3, 4, 6, 7, 9, 11 and 13, and respectfully request reconsideration of the application as amended herein.

Objection to Claim 7

The Examiner objects to claim 7 stating that the use of the term "alignment cut out" is an informality. Particularly, the Examiner states that the metes and bounds of the term "alignment cut out" are unclear to the Examiner.

Applicants submit that the term "alignment cut out" is sufficiently clear and distinct. An example of an "alignment cut out" is set forth in the specification and drawings. (See paragraph 35, page 8; FIG. 3, particularly reference # 350). More particularly, it is stated in paragraph 35 of the application, that in "one embodiment, the alignment cut out 350 is a half circle having a radius of .030 inches and positioned .010 inches away from either the first side 310 or the second side 320."

Additionally, Applicants note that claim 6, from which claim 7 depends, has been amended herein to recite that the alignment feature (further defined as a "cut out" in claim 7) is formed in the lead frame. Thus, the amendment to claim 6 serves to further define the subject term.

Applicants, therefore, submit that the metes and bounds of the term "alignment cut out" are readily discernible and reconsideration of the objection to claim 7 is respectfully requested.

35 U.S.C. § 102(b) Anticipation Rejections

Anticipation Rejection Based on U.S. Patent No. 5,378,924 to Liang

Claims 1 through 4 and 6 through 11 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Liang, U.S. Patent No. 5,378,924. Applicants respectfully traverse this rejection, as hereinafter set forth.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Claims 1 through 4

Independent claim 1 is directed to an integrated circuit package. As amended herein, the integrated circuit package of claim 1 includes: a semiconductor die; a lead frame including a plurality of conductors, at least some of which are coupled to the semiconductor die; insulating material encompassing the semiconductor die and at least a portion of the lead frame; and at least one alignment feature formed in the lead frame, separate from the conductors, *at least partially external to the insulating material*, and *configured to facilitate positive alignment of the integrated circuit package with an external structure*.

Liang teaches a semiconductor package which includes a lead frame thermally coupled to a heat sink. The Examiner points to locating hole 74 in the lead frame 70 of the Liang device as being an alignment feature. However, it is noted that the locating hole 74 is used to locate the lead frame relative to a heat sink during an encapsulation process. Subsequent the encapsulation process, the elongated studs 24a-24d are fixed within the locating holes 74. (See col. 4, line 60 - col. 5, line 7). Applicants, therefore, submit that while the *lead frame 70* may include locating holes 74, once assembled *as an integrated circuit package*, the locating holes may no longer be considered an alignment feature as they can not be used to align the resulting *package* with

anything. Thus, Liang fails to teach an alignment feature *configured to align the integrated circuit package with an external structure*.

Additionally, Liang fails to teach an alignment feature which is formed in the lead frame and which is *at least partially external to the insulating material*.

Applicants, therefore, submit that claim 1 is clearly patentable over Liang.

Applicants further submit that claims 2 through 4 are allowable as being dependent from an allowable base claim as well as for the additional patentable subject matter introduced thereby.

With respect to claims 2 and 3, Liang fails to teach a circular or semicircular alignment feature which is at least partially external to the insulating material.

With respect to claim 4, Liang fails to disclose alignment features located on a first and second end, each being at least partially external to the insulating material.

Applicants, therefore, respectfully request reconsideration of claims 1 through 4 and allowance thereof.

Claims 6 through 11

Independent claim 6 is directed to an integrated circuit package. As amended herein, the integrated circuit package of claim 6 includes: a semiconductor die; a lead frame including a plurality of conductors, at least some of which are coupled to the semiconductor die; at least one alignment feature formed in the lead frame configured to facilitate *positive alignment of the package* with an external structure; and insulating material encompassing the at least one alignment feature, the insulating material being bound by a peripheral edge and *the alignment feature being formed and encompassed along the peripheral edge*.

As noted above, once assembled, the Liang device fails to have an alignment feature which would facilitate alignment of the *package* with an external structure. Additionally, Liang fails to teach an alignment feature formed in the lead frame which is both formed in and encompassed by insulating material along a peripheral edge thereof.

Thus, Applicants submit that claim 6 is clearly not anticipated by Liang.

Applicants further submit that claims 7 and 9 through 11 are allowable as being dependent from an allowable base claim as well as for the additional patentable subject matter introduced thereby.

With respect to claims 7 and 9, Liang fails to teach an alignment cut out or a semicircular shape which is formed and encompassed along the peripheral edge of the insulating material.

With respect to claim 11, Liang fails to disclose alignment features located on a first and second end, formed and encompassed along the peripheral edge of the insulating material.

Applicants, therefore, respectfully request reconsideration of claims 6 through 11 and allowance thereof.

Anticipation Rejection Based on U.S. Patent No. 6,007,357 to Perino et al.

Claims 1 and 4 through 6 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Perino et al., U.S. Patent No. 6,007,357. Applicants respectfully traverse this rejection, as hereinafter set forth.

Claims 1, 4 and 5

As set forth above, independent claim 1, as amended herein, is directed to an integrated circuit package which includes: a semiconductor die; a lead frame including a plurality of conductors, at least some of which are coupled to the semiconductor die; insulating material encompassing the semiconductor die and at least a portion of the lead frame; and at least one alignment feature *formed in the lead frame*, separate from the conductors, *at least partially external to the insulating material*, and configured to facilitate positive alignment of the integrated circuit package with an external structure.

The Examiner cites Perino as teaching an alignment feature "in the form of a left arm (1901) and a right arm (1903)." (Office Action, page 4, paragraph 14). Applicants respectfully disagree with the characterization of the right and left arms as being alignment features. Rather,

Perino teaches that the right and left arms are flexible retaining or locking members from securing a chip 1900 to a base.. Particularly, Perino teaches the following:

“Arms 1901 and 1903 are also referred to as clips 1901 and 1903. Clips 1901 and 1903 *are relatively flexible*, and can be flexed inward when a c[h]ip 1900 is being inserted or removed from a base.” (Col. 16, lines 57-60).

Applicants submit that arms/clips 1901 and 1903 fail to act as an alignment feature, particularly considering Perino's teaching that they are relatively flexible, as such would allow for *misalignment* of the chip relative to the base. More pertinently, Perino never discloses that arms/clips 1901 and 1903 are utilized as alignment features.

Additionally, even if such clips were considered to be an alignment feature (which Applicants maintain otherwise), Applicants submit that the clips are not at least partially externally located relative to the insulating material. Indeed, the clips disclosed by Perino appear to be formed of the insulating material and are asserted by the Examiner to be encompassed by insulating material. (See Office Action, page 5, paragraph 17). As such, they cannot be considered to be partially external to the insulating material.

Further, Applicants submit that Perino fails to teach an alignment feature which is *formed in the lead frame*. As such, Applicants submit that claim 1 is clearly not anticipated by Perino.

Applicants further submit that claims 4 and 5 are allowable as being dependent from an allowable base claim as well for the additional patentable subject matter introduced thereby.

With respect to claim 4, in view of the above arguments regarding clips 1900/1903 not acting as alignment features, Applicants submit that the existence of the clips cannot be viewed as disclosing an alignment feature on both a first end and a second end of the package.

Similarly, with respect to claim 5, Applicants submit that the existence of the clips cannot be viewed as teaching an alignment feature in the form of a protuberance, particularly since Perino fails to teach the use of the clips as alignment features of any kind.

Applicants, therefore, respectfully request reconsideration of claims 1, 4 and 5 and allowance thereof.

Claim 6

As set forth above, claim 6, as amended herein is directed to an integrated circuit package including: a semiconductor die; a lead frame including a plurality of conductors, at least some of which are coupled to the semiconductor die; at least one alignment feature *formed in the lead frame* configured to facilitate alignment of the package with an external structure; and insulating material encompassing the semiconductor die and the at least one alignment feature, the insulating material being bound by a peripheral edge and the alignment feature being formed and encompassed along the peripheral edge.

As discussed above with respect to claim 1, Applicants submit that clips 1901/1903 are not alignment features and that Perino fails to teach that they are utilized as alignment features. Additionally, Applicants submit that Perino fails to disclose an alignment feature which is *formed in the lead frame*. As such, claim 6 is not anticipated by Perino. Applicants, therefore, respectfully request reconsideration of claim 6 and allowance thereof.

Anticipation Rejection Based on U.S. Patent No. 5,369,550 to Kwon

Claims 6 through 8 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Kwon, U.S. Patent No. 5,369,550. Applicants respectfully traverse this rejection, as hereinafter set forth.

As set forth above, claim 6, as amended herein is directed to an integrated circuit package including: a semiconductor die; a lead frame including a plurality of conductors, at least some of which are coupled to the semiconductor die; at least one alignment feature formed in the lead frame configured to facilitate alignment of the package with an external structure; and insulating material encompassing the at least one alignment feature, the insulating material being bound by

a peripheral edge and the alignment feature being *formed along the peripheral edge and also encompassed by the insulating material along the peripheral edge.*

Kwon discloses a method and apparatus for cooling a molded-plastic integrated circuit package. The Examiner cites Kwon as teaching a hole or aperture in the die attach paddle which is aligned with a through hole in the molded package. However, Kwon fails to disclose that either the through hole in the package, or the aperture in the die attach paddle serve as an alignment feature configured to facilitate alignment of the package with an external structure. Indeed, the purpose of both the aperture and through hole are to facilitate air flow from between the package and a mounting surface for purposes of cooling. Nothing is taught regarding the use of these air holes as alignment features.

Additionally, Applicants submit that Kwon fails to teach an alignment feature which is formed in the lead frame and encompassed by insulating material *along a peripheral edge thereof.* Applicants, therefore, submit that claim 6 is not anticipated by Kwon.

Applicants further submit that claims 7 is allowable as being dependent on allowable base claim. Additionally, Kwon fails to teach an alignment cut out formed in the lead frame and which is formed and encompassed by insulating material along a peripheral edge of the insulating material.

Applicants, therefore, respectfully request reconsideration of claims 6 and 7 and allowance thereof.

Anticipation Rejection Based on U.S. Patent No. 5,714,792 to Przano

Claims 6, 10, and 11 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Przano, U.S. Patent No. 5,714,792. Applicants respectfully traverse this rejection, as hereinafter set forth.

As set forth above, claim 6, as amended herein is directed to an integrated circuit package including: a semiconductor die; a lead frame including a plurality of conductors, at least some of which are coupled to the semiconductor die; at least one alignment feature formed in the lead

frame configured *to facilitate alignment of the package with an external structure*; and insulating material encompassing the at least one alignment feature, the insulating material being bound by a peripheral edge and the alignment feature being formed along the peripheral edge and also *encompassed by the insulating material along the peripheral edge*.

The Examiner states that "[i]n paragraph [0036] on p.8-9 of the specification, the applicant has defined an alignment portion to include at tie bar and other parts of the lead frame which provide internal support to the integrated circuit package." (Office Action, page 6, paragraph 23). The Examiner then states that Przano shows an alignment feature in the form of a tie bar (20) which is a part of the lead frame (13) and that it is understood that a plastic package or insulating material will encompass it in the course of fabrication.

Applicants respectfully disagree with Examiner's interpretation of the claim language "an alignment feature," and further submit that, contrary to the Examiner's assertion, the specification fails to support the above stated interpretation.

Applicants submit that, on its face, an "alignment feature" refers to an element or structure, which allows for the proper positioning or adjustment of various components in relation to each other. Indeed, claim 6, as amended herein states that the alignment feature is configured to facilitate positive alignment of the integrated circuit package with an external structure. In contradistinction, a tie bar or die support bar are members of a lead frame known in the art for supporting a semiconductor die during packaging. An alignment feature and a support member are elements, which serve vastly different purposes, and the existence of one does not indicate the existence of the other.

With respect to the Examiner's interpretation of the specification, it is noted that the passage relied on is set forth in explanation the embodiment depicted in FIG. 4. Referring to FIG. 4 and to the related portions of the specification, it is stated that an "integrated circuit 400 is provided with a lead frame 420 having alignment *features* 410." (Specification, page 9, lines 5-6, emphasis added). Furthermore, it is stated that the "lead frame 420 has leads 430 and an alignment *portion* 422." (*Id.*, line 7, emphasis added). It is noted that the alignment *portion* is

part of the alignment *feature* not the entirety thereof. In further describing the embodiment of FIG. 4 it is stated that the "alignment *portion* 422 *includes* a tie bar 424 and also other parts of the lead frame 420 which provide internal support to the integrated circuit package." (*Id.*, lines 7-9, emphasis added). Thus, the tie bar 422 does not even form the entirety of the alignment *portion*. In conjunction with the alignment *portion* (and as part of the alignment *feature*) the "lead frame has cut outs 450 integral therewith, disposed *within* the alignment portion 422." (*Id.*, lines 11-12, emphasis added). It is apparent from FIG. 4 that without the alignment cutouts 450, the tie bar would serve no other purpose than to provide internal support to the integrated circuit package. Thus, the alignment *feature* requires more than just the tie bar, which is referred to in the specification as *part* of the alignment *portion*.

Applicants, therefore, submit that "an alignment feature" as recited in the presently claimed invention cannot be interpreted simply as a tie bar or die support bar. Such an interpretation is not supported by common usage of the term, nor is such an interpretation supported by the specification.

Additionally, Przano fails to teach that the tie bar be used to *facilitate positive alignment of the package with an external structure*.

In view of the foregoing, Przano clearly fails to anticipate claim 6 of the presently claimed invention.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on U.S. Patent No. 6,007,357 to Perino et al. in view of U.S. Patent No. 3,882,807 to Montgomery

Claim 13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Perino et al. (U.S. Patent No. 6,007,357) in view of Montgomery (U.S. Patent No. 3,882,807). Applicants respectfully traverse this rejection, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for a Section 103(a) rejection:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must

be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.** The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). (Emphasis added).

The 35 U.S.C. § 103(a) obviousness rejections of claim 13 is improper because the references fail to teach or suggest all the claim limitations of the presently claimed invention.

Claim 13, as amended herein, is directed to a lead frame strip ready for cutting including a plurality of integrated circuit packages. Each integrated circuit package includes a semiconductor die; a lead frame including a plurality of conductors, at least some of which are coupled to the semiconductor die; insulating material encompassing the semiconductor die and portions of the plurality of conductors; and at least one alignment feature *formed in a portion of the lead frame* separate from and electrically isolated from the plurality of conductors.

The Examiner relies on Perino for teaching an alignment feature in the form of arms/clips 1901 and 1903 as discussed above herein. The Examiner further relies on Montgomery for showing a lead frame strip having two lead frames ready for cutting along a shear line.

As set forth above, Applicants submit that arms/clips 1901 and 1903 fail to act as an alignment feature but rather act as a securing means. Applicants further submit that neither Perino nor Montgomery teach an alignment feature which is formed in a portion of the lead frame which is separate from and electrically isolated from the plurality of conductors. As such, claim 13 is clearly allowable over Perino and Montgomery, either individually or in combination. Applicants, therefore, respectfully request reconsideration and allowance of claim 13.

ENTRY OF AMENDMENTS

The amendments to claims 1, 3, 4, 6, 7, 9, 11 above should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add any new matter to the application.

ENTRY OF NEW CLAIMS

Applicants respectfully request entry of new claims 14 through 16 and submit that they are in condition for allowance. Further, Applicants submit that new claims 14 through 16 do not add any new matter to the application.

CONCLUSION

Claims 1 through 7 and 9 through 16 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney.

Respectfully Submitted,



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Date: September 5, 2001

Enclosure: Version With Markings to Show Changes Made

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**VERSION WITH MARKINGS TO SHOW CHANGES MADE
IN THE SPECIFICATION:**

Please replace the following paragraphs on pages 3 and 4.

[0011] A conductive apparatus has an alignment feature integral therewith. In one embodiment, the conductive apparatus comprises a lead frame and the alignment feature comprises an alignment tab. The alignment tab can have a number of shapes, including, but not limited to, generally square or circular shapes. In addition, the alignment tab or tabs can include two or more apertures for additional alignment options. The alignment feature can also comprise a semi[-]circular shaped cut out on one or more edges of the lead frame. The cut out can be formed in other shapes, such as square or angular shapes.

[0012] Alternatively, an integrated circuit is provided which comprises, in part, a lead frame, a semiconductor die coupled with the lead frame, an alignment feature disposed on the lead frame, and insulating material encompassing the die and a portion of the lead frame. The lead frame has a plurality of conductors which extend out of the insulating material. In one embodiment, the alignment feature comprises an alignment tab. The alignment tab can be removably coupled with the lead frame, for instance, with a perforation line. When an integrated circuit manufacturer desires to remove the alignment tab, the tab is folded over the perforation line until the tab is severed from the lead frame.

Please replace the following paragraph on page 6.

[0028] After the fabricated silicon wafers reach assembly, the dice are then carried through a number of steps to become individual units in leaded packages. After packaging, tests are performed to ensure that the system meets timing requirements and no defects have occurred during the packaging process and/or burn-in. The testing process can include testing at several temperatures to assure performance specifications are met. For each process, it is significant [for] to have the proper alignment of conductors of the lead frames with the testing assembly.

Please replace the following paragraphs on pages 8 and 9.

[0036] Figure 4 illustrates another embodiment of the present invention. A VSMP integrated circuit 400 is provided with a lead frame 420 having alignment features 410. The lead frame 420 has leads 430 and an alignment portion 422. The alignment portion 422 includes a tie bar 424 and also other parts of the lead frame 420 which provide internal support to the integrated circuit package. However, the alignment portion 422 does not include outer rails (not shown) or an outer frame (not shown) which are used during the encapsulation process. The lead frame 420 has alignment cut outs 450 integral therewith, disposed within the alignment portion 422. The alignment cut outs 450 are sized large enough such that mold flash from encapsulation, discussed below, will not interfere with nor fill in the alignment cut out 450. In one embodiment, the alignment cut out 450 has a semi[-]circular shape. Alternatively, other shapes could be used for the alignment cut out 450.

[0037] A semiconductor die 460 includes circuitry formed [on the die 460] thereon. A plurality of bond pads 464 is formed around the periphery of the die 460. The semiconductor die 460 is mounted to the lead frame 420 using leads over chip (LOC) methods, as is known in the art. Electrically conductive wire bonding 480 is used to connect selected bond pads 464 on the die 460 to selected leads 430 or conductors of the lead frame 420.

Please replace the following paragraph on page 11.

[0045] Advantageously, the alignment tabs and the alignment cut outs on the lead frame allow[s] for more precision during alignment of the integrated circuit during testing. The alignment features assist in achieving higher yields after lead conditioning and after testing. During testing, yield loss can occur due to misconnection at test. The alignment features reduce rejects in testing for bent leads caused by improper alignment of the test contacts. The step of retesting of parts failing initial testing due to misalignment is eliminated. The scan time is reduced since the parts can be pre-aligned in the shipping and handling tray. The end user benefits since the parts have built-in alignment features for better placement accuracy. In addition, the built-in features are inexpensive to incorporate into existing designs.

Please replace the Abstract of the Disclosure on page 14 with the following paragraph.

ABSTRACT OF THE DISCLOSURE

An integrated circuit is provided having an alignment feature integral with the lead frame. The integrated circuit includes a lead frame coupled with a semiconductor die, and is partially encapsulated in insulating material. The lead frame has the alignment feature therein. The alignment feature includes a cut out on the lead frame taking the form of a semi[-]circle, protuberance, apertures, or slots. Alternatively, the alignment feature includes a removably coupled tab. After testing of the integrated circuit has been completed, the alignment tab is removed from the integrated circuit. The alignment feature can also be provided on a heat spreader which is attached to a side of or within the lead frame package.

IN THE CLAIMS:

1. (Amended) An integrated circuit package comprising:
a semiconductor die;
a lead frame including a plurality of conductors, at least some of which are coupled to the
semiconductor die; [and]
insulating material encompassing the semiconductor die and at least a portion of the lead frame;
and
at least one alignment feature formed in the lead frame separate from the plurality of conductors
and at least partially external to the insulating material, the at least one alignment feature
being configured to facilitate positive alignment of the integrated circuit package with an
external structure.
3. (Amended) The integrated circuit package of claim 1, wherein the at least one alignment feature is [semi-circular] semicircular shaped.
4. (Amended) The integrated circuit package of claim 1, [further comprising an insulating material encompassing the semiconductor die and a portion of the plurality of conductors, the insulating material comprising] wherein the integrated circuit package includes a first end and a second end, and wherein the at least one alignment feature comprises an alignment feature disposed on both the first end and the second end of the [insulating material] integrated circuit package.
6. (Amended) An integrated circuit package comprising:
a semiconductor die;
a lead frame including a plurality of conductors, at least some of which are coupled to the
semiconductor die;
at least one alignment feature formed in the lead frame separate from the conductors and
configured to facilitate positive alignment of the integrated package with an external

structure; and
insulating material encompassing the semiconductor die and the at least one alignment feature,
the insulating material being bound by a peripheral edge, wherein the alignment feature is
formed and encompassed along the peripheral edge.

7. (Amended) The integrated circuit package of claim 6, wherein the at least one alignment feature is an alignment [cut-out] cut out.

9. (Amended) The integrated circuit package of claim 6, wherein the at least one alignment feature is [semi-circular] semicircular shaped.

11. (Amended) The integrated circuit package of claim 6, wherein the [further comprising a] lead frame [having] includes a first end and a second end, wherein the at least one alignment feature comprises an alignment feature disposed on both the first end and the second end of the lead frame.

13. (Amended) A lead frame strip ready for cutting, the lead frame strip comprising a plurality of integrated circuit packages, each integrated circuit package comprising:
a semiconductor die;
a lead frame including a plurality of conductors, at least some of which are coupled to the semiconductor die;
insulating material encompassing the semiconductor die and portions of the plurality of conductors; and
at least one alignment feature formed in a portion of the lead frame separate from the conductors
and electrically isolated from the plurality of conductors.